

## SCIENTIFIC NOTES

**The American Toad as Champion Carabid Beetle Collector.**—The American Toad (*Bufo americanus* Holbrook) has been reported as a predator of Carabidae (Coleoptera) by Kirkland (1897. Hatch Exp. Sta. Mass. Agric. Bull., 46: 1–30; 1904. U. S. Dept. Agric. Farmer's Bull., 196: 1–16), Garman (1901. Kentucky Agric. Exp. Sta. Bull., 91: 60–68), Stoner (1937. Florida Entomol., 19: 49–53), Smith and Bragg (1949. Ecol., 30: 333–349), and also by Bush (1959. Herpetol., 15: 73–77).

From May to October 1973, I collected and analyzed the stomach contents of 342 American toads from southern Québec in order to determine the extent of predation on carabid beetles. Immediately after capture, the animals were killed in hot water, their stomachs removed and the contents emptied into a small dish of water. The total number of species of carabid beetles in the toads was 98, and the maximum of individuals in one toad was 17. In addition, remains of 19 species were found in toads' excreta. The diet of the American toad is determined mostly by relative availability of prey items (Smith and Bragg 1949), and selectivity of prey is probably a factor of minor importance. The amphibians live, on the whole, in the same habitats as carabid beetles, and both are predominantly active nocturnally, partly explaining the large consumption of Carabidae by toads.

The number of each species of prey is listed below. Numbers in parentheses indicate additional individuals found in excreta. *Agonum* sp., 6 (28), *A. crenistriatum* Leconte, 47, *A. cupripenne* Say, 12 (1), *A. decentis* Say, 1, *A. harrisi* Leconte, 1, *A. melanarium* Dejean, 8, *A. placidum* Say, 41 (6), *A. propinquum* Gemminger and Harold, 1, *A. puncticeps* Casey, 1, *A. retractum* Leconte, 6, *Amara* sp., 40 (8), *A. aenea* DeGeer, 41 (8), *A. angustata* Say, 2, *A. apricaria* Paykull, 2, *A. avida* Say, 3, *A. convexa* Leconte, 2, *A. discors* Kirby, 2, *A. familiaris* Duftschmid, 1, *A. impuncticollis* Say, 3, *A. latior* Kirby, 4 (1), *A. littoralis* Mannerheim, 1, *A. musculus* Say, 5, *A. obesa* Say, 14 (1), *A. quenseli* Schönherr, 33 (8), *A. rubrica* Haldeman, 2, *Anisodactylus discoideus* Dejean, 1, *A. harrisi* Leconte, 5, *A. kirbyi* Lindroth, 1, *A. merula* Germar, 21, *A. nigerrimus* Dejean, 2, *A. nigrita* Dejean, 1, *A. rusticus* Say, 3, *A. sanctaerucis* Fabricius, 6, *Anisotarsus nitidipennis* Leconte, 2, *A. terminatus* Say, 2, *Badister notatus* Haldeman, 1, *Bembidion frontale* Leconte, 2, *B. nitidum* Kirby, 3, *B. patrulele* Dejean, 2, *B. punctatostriatum* Say, 1, *B. quadrimaculatum oppositum* Say, 8, *B. stephensi* Crotch, 1, *B. tetracolum* Say, 2, *Bradycellus* sp., 1, *B. nigriceps* Leconte, 1, *B. rupestris* Say, 1, *B. semipubescens* Lindroth, 1, *Calathus* sp., 1, *C. gregarius* Say, 2, *C. ingratus* Say, 1 (2), *Calleida punctata* Leconte, 3, *Calosoma calidum* Fabricius, 1 (1), *Carabus nemoralis* Müller, 4, *C. serratus* Say, (1), *Chlaenius lithophilus* Say, 2, *C. pennsylvanicus* Say, 1, *C. tomentosus* Say, 4, *C. tricolor* Dejean, 1, *Clivina* sp., 1, *C. fossor* Linné, 13, *Cymindis americana* Dejean, 1, *C. borealis* Leconte, 1, *C. cribricollis* Dejean, 3 (4), *C. pilosa* Say, 1, *Dicaelus politus* Dejean, 1, *Diplocheila obtusa* Leconte, 2, *Dromius piceus* Dejean, 1, *Dyschirius globulosus* Say, 4, *Geopinus incrassatus* Dejean, 22, *Harpalus* sp., 6 (3), *H. affinis* Schrank, 72 (11), *H. bicolor* Fabricius, 9, *H. caliginosus* Fabricius, 1, *H. egregius* Casey, (1), *H. erraticus* Say, 12, *H. fallax* Leconte, 1, *H. fuliginosus* Duftschmid, (1), *H. funerarius* Csiki, 1, *H. herbivagus* Say, 13, *H. indigenus* Casey, 7, *H. lewisi* Leconte, 3, *H. opacipennis* Haldeman, 5, *H. pennsylvanicus* DeGeer, 13, *H. pleuriticus* Kirby, 2 (2), *H. viduus* Leconte, 1, *Loricera pilicornis* Fabricius, 8,

*Metabletus americanus* Dejean, 3, *Notiophilus aquaticus* Linné, 1, *Olisthopus parvatus* Say, 1, *Omophron americanum* Dejean, 3, *Patrobis longicornis* Say, 1, *Pseudamara arenaria* Leconte, 1, *Pterostichus* sp., (6), *P. adstrictus* Eschscholtz, 1, *P. coracinus* Newman, 1 (1), *P. corvinus* Dejean, 9 (1), *P. lachrymosus* Newman, 1, *P. leconteianus* Lutshnik, (2), *P. luctuosus* Dejean, 4, *P. lucublandus* Say, 27 (30), *P. melanarius* Illiger, 11, *P. mutus* Say, 10, *P. pensylvanicus* Leconte, 7 (2), *P. tristis* Dejean, 1, *Selenophorus gagatinus* Dejean, 3, *Sphaeroderus lecontei* Dejean, 1, *Stenolophus comma* Fabricius, 3, *S. conjunctus* Say, 4, *Synuchus impunctatus* Say, 11, *Tachys incurvus* Say, 1, undetermined species, 31 (17).

These data suggest that the American toad may not be entirely beneficial as a predator of noxious insects, since many Carabidae, especially larger species, are important predators of lepidopterous larvae and other destructive insects (Blatchley, 1910. The Coleoptera or Beetles known to occur in Indiana; Balduf, 1935. The Bionomics of Entomophagous Insects).

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**Notes on the general biology of the flatheaded fir borer *Melanophila drummondi* Kirby reared from ponderosa pine (Coleoptera: Buprestidae).**—*Melanophila drummondi* Kirby is a common metallic wood borer of dying, slow growing, freshly cut, or wind-thrown Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, and western hemlock, *Tsuga heterophylla* (Raf.) Sarg., in Washington state. Chamberlin (1926, *The Buprestidae of North America exclusive of Mexico*) has cited many other host species. Barr (1971, in Hatch, *The beetles of the Pacific Northwest*, Part V. University of Washington Press, Seattle, Washington) adds white spruce, *Picea glauca* (Moench) Voss, to Chamberlin's list of hosts for *M. drummondi*. Anderson (1966, *Forest and shade tree entomology*) mentions pine as being a host for *M. drummondi*, but does not indicate which species, nor could I find any other reference identifying pine as a host for this buprestid. I recently found *M. drummondi* to occur on ponderosa pine, *Pinus ponderosa* Laws.

Infestation of host material by *M. drummondi* occurs shortly after spring cutting or windfall and extends through early fall at low elevations. At higher elevations, infestation may be delayed by a month or more due to slower maturation of larvae and later emergence of adults. Maturation of larvae generally occurs within a year, but may take several years when live trees are attacked (Anderson, 1966).

On March 15, 1973, I placed several 1 m long bolts of ponderosa pine cut from a tree felled in the spring of 1972, 2 miles northeast of Liberty, Kittitas County, Washington, into a plywood rearing chamber maintained at 20.6°C and 78% relative humidity. The first *M. drummondi* emerged on April 22, and emergence continued until July 4, 1973, yielding a total of 12 males and 10 females. *Melanophila gentilis* LeConte, a common buprestid inhabitant of ponderosa pine, was also reared from the ponderosa pine bolts (30 ♂♂, 22 ♀♀).

The first insects noted to emerge were two individuals of the parasitoid